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## TUMBLE-BUGS\*.

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"Tumble-bugs" have been interesting to human beings for centuries. As these chubby insects roll their balls across paths, roads, and walks, persons stop to puzzle, and whether country boys, soldiers, golfers, or scientists, all are fascinated by the ball-rolling habit of these creatures.

Superstitions concerning the sacred beetles, *Ateuchus sacer* Fab., *Scarabaeus Aegyptiorum* Latr., or related species, have existed for centuries (Wade 1922). Emblems of the sacred beetle, one of the tumble-bugs, were linked with the religious beliefs of the ancient Egyptians and are to be found in tombs. During the process of embalming the dead, these insects were placed on the chest and under the eyelids of the deceased to symbolize the belief that the heart would sometime pulsate again and that the eye would flash.

In recent years some entomologists have tried to prove that the dung beetles are of economic importance, but slight positive evidence has been shown. There are as many as two hundred dung beetle burrows to the acre in some localities (Lindquist 1933). This indicates that about twenty-one pounds of air-dried dung has been buried and one hundred twenty-six pounds of soil excavated per acre, thus some fertilization (Cameron 1925), some soil interchange, and some soil aeration may occur. Specimens of *Canthon laevis* Drury were shipped into Porto Rico with the hope that they would reduce the amount of manure and thus reduce the numbers of the pest known as the horn fly, whose maggot lives in dung, but this was unsuccessful (Wolcott 1922).

Let us follow the tumble-bug through some of his ways of living. He does not reside in the manure but goes there to feed, to make balls for storing, or to make balls in which to lay eggs. Some lamellicorn scavengers eat fungi and carrion but the ball-rolling kinds prefer such materials as cow manure. As the insect goes to work making the ball he moves his spade-shaped head down in order to roll a small piece of dung back under himself. Then with his forelegs this small ball-like piece is pushed back between the middle legs which are being used for balancing the insect, and on to the hind legs where it is held while other pieces are cut off, passed back, and firmly packed onto the first. This procedure continues as the hind legs scrape and shape the ball.

Now that the ball is made it must be rolled to a suitable burying ground, for it has been suggested that some of the many kinds of insects which frequent dung are predaceous insects and would prey upon the tumble-bug larva if it were to hatch out in the original dung pile (Comstock 1930). The female may start pushing the ball alone (Slingerland 1896), the female of *Gymnopleurus sinuatus* Fabr. may push and the male pull (Arrow 1931), or the male may travel

\*Thanks are due to Dr. W. H. Wellhouse, Professor of Zoology, and Dr. H. H. Knight, Professor of Entomology, Iowa State College, for guidance and encouragement during this study.

backwards and unaided push the ball with his hind legs (Esherich 1896) while the female follows a short distance behind. Some ardent naturalists have accredited ball-rolling beetles with great ingenuity and resourcefulness because the pellet seems to be tumbled along over many seemingly impassable obstacles with surprising speed and in a definite direction. Although the Egyptians did believe the tumble-bugs to have supernatural powers they are probably not super-insects. Troubles may beset the rightful owner of the ball for another tumble-bug **may** rob him of his possession. At times the intruder may appear to be aiding the laborer by pushing, but in reality he is slowing up the ball-rolling (Heymons and von Lengerken 1929). A genuine insect fight may occur after which the victor proceeds with the pellet. At other times a person or other large animal may disturb the insect and it runs, flies, or draws in its legs and feigns death. In the latter case he may appear so much like a fallen weed seed or piece of soil that he escapes the human eye.

A few feet away from the original droppings the digging of a burrow is started under the ball. One insect may dig with his forelegs and head while another perches on the sinking ball. The author has seen a ball rolled six feet in the rather short time of three minutes and buried in seven more minutes. The burrows dug by different genera of Coprini may be of various shapes and depths (Lindquist 1933). Burrows dug during the fall for the hibernation of one or two beetles are deep, straight, free from dung, far from the original source of manure, and closed with soil. Burrowing may continue into October but takes place among the Coprini mostly in May and June at which times the holes are shallow and are varied in shape. Some dung beetles which are not ball-rollers may dig tunnels and store chunks of manure while *Canthon lecontei* Horn may find a rabbit pellet, dig a pit under it, and drop the little ball in (Warren 1917).

The buried ball of the common tumble-bug serves either as immediate food for the adults or as a place for depositing the egg. If for the former purpose, then the adults feed from under the pellet. If for the latter purpose, the female of *Scarabaeus laticollis* L. (Arrow 1931) makes a flanged, saucer-shaped depression on the side of a ball, lays a large, creamy-colored, glazed egg (sometimes one-fourth inch long) in the depression, folds the flange inward over the egg in such a way that the egg is covered but has ample air space. She fills the hole of the burrow as she leaves the pellet (now pear-shaped) behind where it will not become dessicated. In the past it was thought that the rolling was necessary to develop the egg. Now we know this to be false.

In a few days the egg hatches and the larva feeds on the surrounding dung. If something breaks open the ball the larva of *Canthon laevis* closes the cracks as it plasters them shut with black, muddy-looking faecal matter exuded from its intestine. When the ball is completely hollowed out, the larva gives the interior walls of its spherical home a coat of faecal matter in order to harden them. The pupal stage is assumed within this dark cell and in about four weeks the adult has developed but does not emerge until wet weather has softened the cell and the surrounding soil.

It would be worth anyone's time to place a few specimens of *Canthon*

*laevis* in a covered terrarium with soil and manure, and to watch them make their pellets, roll them, and bury them. One can even dig up the ball and, if it is pear-shaped (round balls seldom contain eggs), remove the large creamy-white egg from the prolonged side of the pellet. If one is careful about removing the piece of dung when uncovering the egg, he may stick it back in place to prevent dessication and the larva will hatch out in a few days. Now the observer can remove a very small portion of the ball to expose the larva and immediately the hole is plugged by the exuded matter from the intestine. With a little patience the life cycle may be studied until the adult is developed.

The digestive canal of *Canthon laevis* is about ten times the total body length and ninety per cent of it is the ventriculus or digestive region (Cooper 1938). Covering its outer surface are a great many small sacs which may give off digestive juices. No wonder this insect can extract nourishment from waste food which has already been through the digestive tract of one animal. The food tube is coiled like a watch spring as it lies in the abdominal cavity. Another rather interesting fact is that the female is not prepared to lay the large number of eggs so commonly produced by insects. She has only one ovary instead of the usual two, and in this the few eggs originate.

And why do numerous little flies follow the ball and even allow themselves to be buried with it? Why do red mites cling to every joint of some of the hard-working parents? Why is the loser of a fight between two tumble-bugs sometimes forced over on his back with forelegs folded under his mouth? Man goes on wondering and marveling with yet much to learn concerning the "hows" and "whys" of the sturdy tumble-bug's life.

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#### FOUR MORE NEW SPECIES OF MEALYBUGS FROM NEW YORK STATE. (HEMIPTERA: KERMIDAE AND PSEUDOCOCCIDAE).

BY GEORGE J. RAU,

West New York, N. J.

**Eriococcus saratogensis n. sp.**

(Fig. 1)

Described from a series of specimens.

Holotype deposited in my own collection.

Paratypes in various institutional collections.

*Adult Female*: In Life:—Enclosed in a tough, brownish-white, felted, elongate sac, on the underside of the leaves of *Hystrix patula* Moench and on several other undetermined species of grasses. Living insects removed from sacs are dark red, retaining that color in KOH.

*Type Locality*:—Saratoga Springs, N.Y., Sept. 11, 1936 and Sept. 6, 1937.

*Morphological Characters*:—Length, 2.25 mm., width, 1.25 mm.; elongate; antennae (f) six segmented, each segment with the following lengths: I, 40 $\mu$ ; II, 32 $\mu$ ; III, 88 $\mu$ ; IV, 20 $\mu$ ; V, 20 $\mu$ ; VI, 36 $\mu$ ; margin of dorsum with an uninterrupted series of large, stout, tapering, posteriorly blunt-pointed (ii), anteriorly sharp-pointed (i2) spines of which from three to four are present in each abdominal segment; ventral marginal region with or without a small spine in each of the abdominal or thoracic segments; intermediate region of the dorsum with from two to seven minute spines (h1) and a series of very minute structures similar in shape to h2 in each of the abdominal and thoracic segments; dorsal tubular ducts (c) fairly large and numerous with the characteristic cup-shaped distal ends found in the genus *Eriococcus*, rim and cup of the tubular ducts chitinized, no tubular ducts present on the ventral side; small multilocular disc pores (j) distributed over the venter, more numerous in the anal lobes and intersegmental regions of the abdomen, differing slightly in structure from the multilocular pores found in the genera *Phenococcus* and *Pseudococcus*; ventral body setae long and slender, present in an irregular transverse series on each abdominal segment and in the immediate region between the antennae and the first pair of legs; legs long and slender, subequal, with the following formula:

	Coxa	Trochanter	Femur	Tibia	Tarsus
Fore limb	80 by 80	65	150	115	140
Mid limb	80 by 80	65	150	115	140
Hind limb	80 by 80	65	150	115	150

Hind coxae (g) with a few irregular clear areas; tarsal claw (a) with a pair of long slender digitules dilated at their distal ends; parts of anal lobes slightly chitinized, especially about the ventral setae; anal lobe setae very long, 270 $\mu$ , dorsal side of anal lobe with three spines, two on inner margin and one on outer margin, ventral side with three long, slender setae; anal ring with one row of cerors and eight setae, each approximately one-third as long as the anal lobe setae; ventriculus long and narrow.

I learn from Prof. Ferris that the above species is of the same general type as *E. kemptoni* Parrott and *E. smithi* Lobdell. It differs from both of those species in having six instead of seven segmented antennae; from the former in having a larger number of marginal spines, three or four occurring in each abdominal segment, and the legs longer, while the other has only two marginal spines in each abdominal segment and the legs with the following formula, femur together with the trochanter 130-120 $\mu$  and the tarsus 84-105 $\mu$ ; from the latter, the cup of the tubular duct is wholly chitinized, the minute spines of the dorsal side are less numerous (six, six, and four in the fifth, sixth, and seventh abdominal segments), only parts of the anal lobes are slightly chitinized, and the multilocular disc pores are more abundant (over 200 in the last three abdominal

segments), in *E. smithi* only the inside of the cup of the tubular duct is chitinized, the minute spines of the dorsal side are found in the following numbers-fourteen, twelve, and ten in the fifth, sixth and seventh abdominal segments, the anal lobes are chitinized and the multilocular pores are less abundant (less than 125 on the last three ventral abdominal segments).

I have reared two species of undetermined *Chalcididae* from this insect.

**Hypogeococcus** n. gen.

(Fig. 2)

In an effort to place the following species in a genus, I have gone through the literature on the genera of the *Pseudococcidae* and have been unable to find one within which this species will fit so that the following new genus is described:

Two pairs of dorsal ostioles present; antennae with seven segments (t); large, short, broadly conical spines (i) present along the margins of the last four or five abdominal segments; in the anal ring (e) the bases of each of the cephalic pair of setae are connected with the bases of each of the median pair of setae by a chitinized bar, lying between the lateral and the mesal orbacerores, which does not continue to the bases of each of the caudal pair as is usually the case in the genus *Pseudococcus*, but extends in front of the bases of each of the caudal pair; a clear area is present between the inner margins of both the anal ring and the mesal orbacerors of the anal ring, extending between the cephalic and median pair of the anal ring setae, with the margins of the sides concave.

This insect is a rather queer little creature with the heavy conical spines. Prof. Férris writes me that "It actually approaches in certain respects some of the things which are getting over toward *Antonina*."

**Hypogeococcus barbareae** n. sp.

(Fig. 2)

Described from a long series of specimens.

Holotype deposited in my own collection.

Paratypes deposited in various institutional collections.

*Adult Female*: In Life:—Subterranean. Living in large colonies on the roots of wild aster, *Aster sp.*, completely covered with loose, white waxy secretion; not associated with ants. Insects devoid of secretion are dark red, retaining the color in KOH.

*Type Locality*:—Saratoga Springs, N. Y., Sept. 11, 1936 and Sept. 6, 1937.

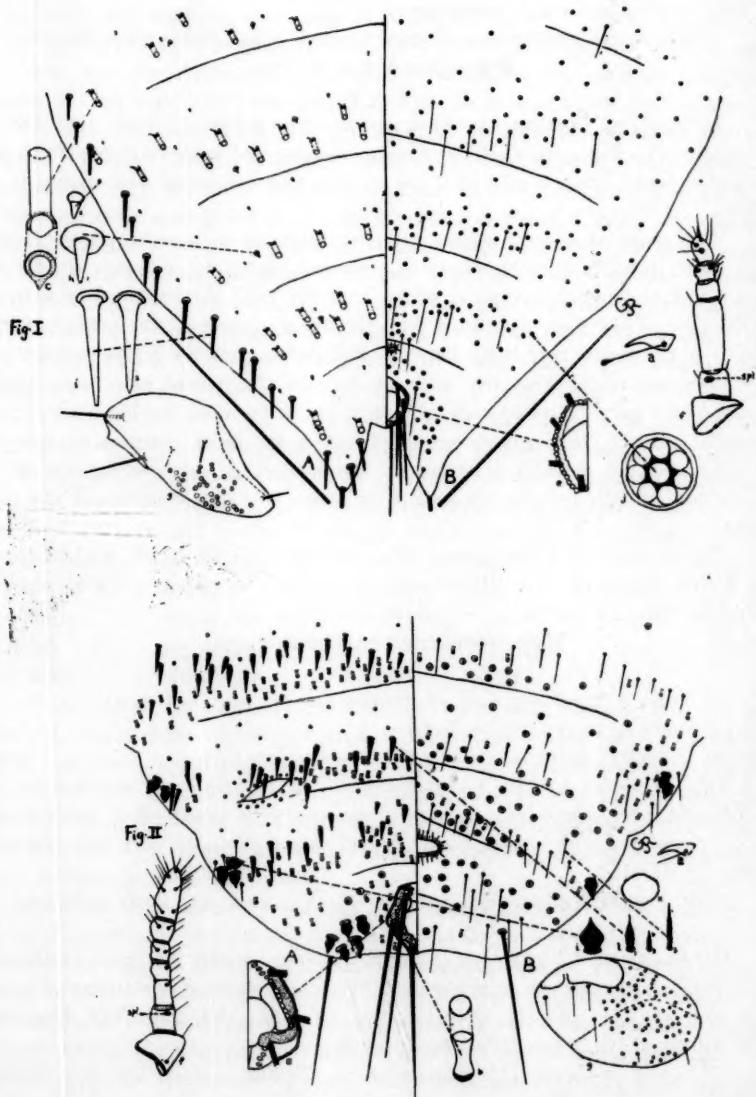
*Morphological Characters*:—Length, 1.5 mm., width .75 mm.; uniformly elongate oval; antennae seven segmented (f), each segment with the following lengths:—I, 40 $\mu$ ; II 30 $\mu$ ; III, 30 $\mu$ ; IV, 22 $\mu$ ; V, 18 $\mu$ ; VI, 24 $\mu$ ; VII, 60 $\mu$ ; legs normal, subequal, with the following formula:—

	Coxa	Trochanter	Femur	Tibia	Tarsus
Fore limb	68	60	94	70	66
Mid limb	78	60	110	74	68
Hind limb	90	60	112	98	72

Coxae of hind pair of legs (g) with numerous small pores; tarsal claw (a) without an inner tooth and with a pair of non-dilated digitules; body with four

CAN. ENT. VOL. LXX.

PLATE 16

Fig. I *Eriococcus saratogensis* n. sp. Fig. II *Hypogeococcus barbarae* n. sp.

E 16

or five pairs of cerarii on the last four or five abdominal segments, the anal lobe pair slightly tuberculate dorsally; cerarii not definitely recognizable on the other segments, each cerarius bearing from two to six conspicuously large, short, broadly conical spines which are slightly constricted at their bases, and three to five triangular pores but no setae; venter of anal lobe with a large seta about  $132\mu$  long, and three to five much smaller auxiliary setae; anal ring (e) on the dorsal side with six setae, each  $140\mu$  long which is slightly longer than the anal lobe setae; ventrally multilocular pores in great numbers on the last four or five abdominal segments, gradually decreasing in numbers toward the cephalic end of the body, with small numbers in clusters present in the regions about the mouth-parts, spiracles and where the legs are attached to the body; dorsally, four to eight multilocular pores present in the last abdominal segment proximad to the anal ring; triangular pores present both dorsally and ventrally, but dorsally absent from the intersegmental regions where the tubular ducts are present in the abdominal segments and ventrally absent in the last four abdominal segments, small clusters of triangular pores present about the openings of the two pairs of spiracles; tubular ducts (b) very numerous dorsally, present in several irregular transverse rows in the posterior half of each abdominal segment and generally distributed over the other regions of the body, ventrally sparsely present; dorsal body setae (11) fairly large and conical, occurring in an irregular transverse series in each of the abdominal segments and over the rest of the body,  $2/3$ rds the length of the ventral body setae (13), and decreasing in numbers, size and thickness (12) toward the anterior part of the body; ventral body setae (13) relatively more slender occurring in much the same manner as the dorsal body setae but slightly more numerous, a small cluster found in the region between the antennae and the anterior part of the mouth-parts; circulus (k) circular in outline, slightly longer than wide, the rim only taking a stain; ventriculus quadrate.

The above species was compared with the cotype slide mount of *Ripersia lasii* Cockerell in the King Collection in the American Museum of Natural History, New York City, which was found on the roots of aster in Massachusetts in 1896. From what I can gather from the mount of *R. lasii*, the antennae are six segmented, one pair of cerarii are present in the last abdominal segment and no pores or clear areas occur on the hind pair of coxae.

I have had large numbers of specimens under observation but was unable to rear out any parasites from *H. barbara*.

The species is named in honor of my mother, Mrs. Barbara Rau.

**Pseudococcus patulae** n. sp.

(Fig. 3)

Described from a series of specimens.

Holotype deposited in my own collection.

Paratypes deposited in various institutional collections and in my own collection.

*Adult Female*: In Life:—Living solitary, exposed on the underside of the leaves of *Hystrix patula* Moench and several other species of undetermined grasses. Dorsum naked, devoid of waxy secretion, grayish-red in color, with numerous long, slender, glassy rod-like hairs projecting from the dorsum, in which respect it looks very similar to *Pseudococcus pulverarius* Newstead. Ovisac well developed, protruding from the underside of the body. Insects turn dark red

CAN. ENT. VOL. LXX.

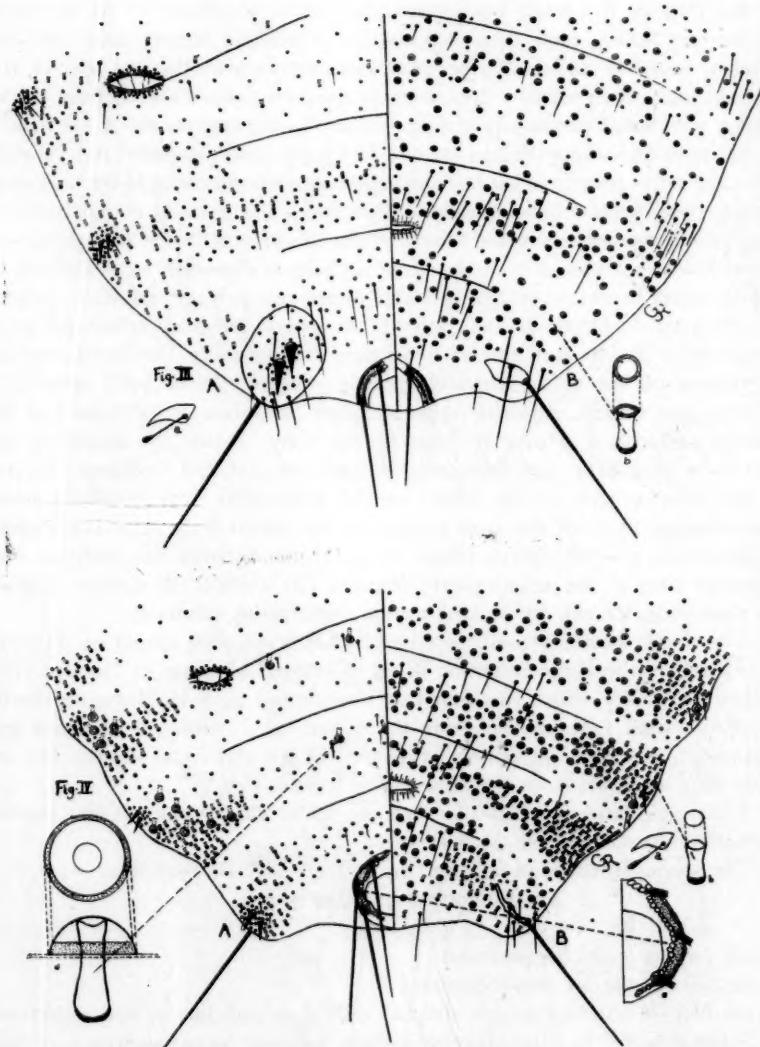
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PLATE 16

Fig. III *Pseudococcus patulae* n. sp. Fig. IV *Trionymus geranii* n. sp.

in KOH.

*Type Locality*:—Saratoga Springs, N. Y., early September, 1936.

*Morphological Characters*:—Length, 2.5 mm., width, 1.25 mm.; antennae eight segmented; legs normal, subequal, tarsal claw with a pair of setae dilated at their distal ends; body with sixteen to seventeen pairs of cerarii, the second pair from the cephalic end hardly discernable and sometimes obliterated, each of the cerarii with a pair of conical spines, two to eight auxiliary setae (anal lobe with eight to twelve) and two to fourteen triangular pores (more numerous in the anal lobe pair), the size of the spines and the number of pores gradually decreasing toward the anterior part of the body; each of the anal lobe cerarii surrounded by a large ovoid chitinized area; ventral side of anal lobe with a small triangular area, from the posterior end of which projects the anal lobe seta  $200\mu$  long, and midway along the anterior margin extends a smaller seta; in addition, four or five auxiliary setae together with a small number of multilocular pores are present in the anal lobe area; anal ring with six setae, each  $160\mu$  long; multilocular pores in great numbers on the venter of the abdomen decreasing in numbers cephalad, with a very small number present in the immediate region between the antennae and the hind pair of legs; dorsally, one present just laterad of the anterior part of the chitinized ovoid area of each of the anal lobe cerarii, and two or three in the regions both caudad and cephalad from, and in the first and second segments anterior to, each of the posterior pair of dorsal ostioles; triangular pores generally distributed both dorsally and ventrally, more abundant dorsally but absent from the areas of articulation of the abdominal segments; tubular ducts narrowly rimmed (b) but not ringed at the ends confluent with the surface of the body, of two kinds, similar in lengths but differing in their diameters, the larger in small numbers in a continuous series both dorsally and ventrally along the abdominal margins from the thirteenth to the seventeenth pair of cerarii, in the mediate regions more abundant dorsally interspersed with the triangular pores in uneven transverse rows on each abdominal segment and in small numbers over the other parts of the body, the smaller tubular ducts in small numbers both dorsally and ventrally, variably associated with the larger ducts at the posterior end of the body; dorsal body setae long and slender, in small numbers on the abdominal segments and the anterior part of the body; ventral body setae longer and more numerous, present in an irregular transverse series or in small clusters in each of the abdominal segments or in the region between the antennae and the mouth parts where they reach their greatest lengths; circulus quadrate; ventriculus long and narrow.

Locally this species most closely resembles *Pseudococcus comstocki* Kuwana by the shapes of the chitinized areas on the dorsal and ventral sides but can be separated from that species by the presence of narrowly rimmed tubular ducts, absence of the ringed tubular ducts and the presence of only a pair of spines in each cerarius; in *P. comstocki* ringed and non-rimmed tubular ducts are present and three to four conical spines occur in each cerarius of the first five or six pairs.

***Trionymus geraniae* n. sp.**

(Fig. 4)

Described from a series of specimens.

Holotype deposited in my own collection.

Paratypes deposited in various institutional collections and in my own collection.

*Adult Female*: In Life:—Living solitary, exposed on the underside of the leaves or in the axils where the leaves join the main stem of *Geranium Robertianum* Linnaeus. Wax evenly distributed over the dorsum of the body, except in the segmentation where the body color appears to be green. Specimens devoid of secretion, green, freshly killed specimens turn green in KOH. After a period of time the body contents of dead dry specimens turn dark red, retaining the color in KOH. Ovisacs long and well developed, arising from the underside of the posterior part of the body.

*Type Locality*:—Saratoga Springs, N.Y., early September, 1936 and Sept. 6, 1937.

*Morphological Characters*:—Length, 2.5 mm., width, 1.25 mm.; elongate oval; antennae eight segmented, each segment with the following lengths: I, 56 $\mu$ ; II, 58 $\mu$ ; III, 56 $\mu$ ; IV, 39 $\mu$ ; V, 49 $\mu$ ; VI, 39 $\mu$ ; VII 42 $\mu$ ; VIII, 97 $\mu$ ; legs normal, subequal, with the following formula:

	Coxa	Trochanters	Femur	Tibia	Tarsus
Fore limb	125	80	200	170	80
Mid limb	150	80	215	210	100
Hind limb	150	108	230	250	100

Tarsal claw with a pair of digitules dilated at their distal ends; body with from two to six pairs of cerarii along the margins of the last two or six abdominal segments, cerarii not definitely recognizable in the other segments, each cerarius with two spines, two to five triangular pores and no auxiliary setae except in the anal lobe pair in which there are three present; ventral side of anal lobe with or without a chitinized bar which when present is similar in shape to that found in *Pseudococcus citri* Risso, from the posterior end of which projects the anal lobe seta 216 $\mu$  long, and midway along the anterior margin of the chitinized bar protrudes, a small seta; in addition, four other setae are present on the venter of the anal lobe; anal ring with three pairs of setae, each 170 $\mu$  long, the caudal pair of setae widely separated apart from each other; ventrally, the multilocular pores are arranged in several irregular transverse rows on each abdominal segment together with a pair present in the regions laterad of the bases of the pleural sclerites of the first pair of legs; triangular pores present in great numbers both ventrally and dorsally, especially on the dorsal side, but absent from the areas of articulation of the abdominal segments of that side; tubular ducts of two distinct types, the raised ringed tubular ducts (d) which are found only dorsally in about fourteen transverse rows each containing from three to nine ducts, the number decreasing toward the anterior part of the body, in the penultimate segment there are from twelve to sixteen ringed tubular ducts, the diameter of the ringed portion of the ducts is about 10 $\mu$  and the outer ringed part is narrowly rimmed; the non-ringend tubular ducts are of two kinds, differing only in their diameters, the smaller of which occur very sparingly while the larger are present in great numbers on the ventral and dorsal intersegmental marginal and submarginal regions of the abdomen, also present ventrally in small numbers along the anterior borders of the multilocular pores in the abdominal region and in large clusters laterad of the bases of the pleural sclerites of the first pair of legs; dorsal body setae sparse, small and slender, more abundant and longer in the head

region; ventral body setae longer and relatively more abundantly than the dorsal body setae, especially in the region between the antennae and the anterior part of the mouth parts where they are approximately one-half the length of the anal lobe setae; ventriculus long and narrow.

This species is somewhat similar to *Thionymus mori* Lobdell from which it can be separated by the following characters: *T. geraniae*--no clear areas on either the hind coxae or tibia; large ringed tubular ducts more abundant, mostly occurring in the areas about the cerarii, sixteen and twelve respectively present in the sixth and seventh abdominal segments; in all my specimens from two to six pair of cerarii are present. *T. mori*--hind coxa with numerous clear areas or pores on the lateral aspect, tibia with a few pores; four and six large ringed tubular ducts present in the sixth and seventh abdominal segments but not in the regions of the cerarii; number of pairs of cerarii varying, usually two or three pairs recognizable or sometimes with as many as six on one side.

This insect is heavily attacked by parasites as indicated by the presence of larvae in prepared slide mounts, however I have been only able to rear out one specimen of Chalcid.

#### EXPLANATION OF TERMS

A. Dorsal view. B. Ventral view. a. Claw of tarsus. b. Various types of non-ringed tubular ducts. c. Tubular duct-*E. saratogensis*. d. Ringed tubular duct-*T. geraniae*. e. Anal ring. f. Antenna. g. Coxa, h, i, 2. Various types of body spines or setae-*E. saratogensis*. i, 1, 2 Marginal spines j. Multilocular disc pores-*E. saratogensis*. k. Circulus-*H. barbara*e. l, 1, 2, 3. Various types of body setae-*H. barbara*e. spl. Spinelike process (See Stickney, F. S., U. S. Dept. Agri. Tech. Bull. 104, 1934, page 10).

### TWO NEW NEARCTIC SILVIUS (DIPTERA).

BY L. L. PECHUMAN.

Cornell University, Ithaca, N.Y.  
*Silvius philipi* n. sp.\*

Female. Length, 9.6 mm.

**Head.** Frontoclypeus and cheeks grayish white pollinose with rather long white hairs which are quite dense below; a small area in center of frontoclypeus denuded; also two very small denuded areas on the lower portion of each cheek; front above antennae grayish white pollinose shading to yellowish brown toward the vertex; front and vertex with many long black hairs. Frontal callosity brownish black and somewhat shining; about one half width of front. Antennae very stout for a *Silvius*; all segments black, first two segments with dense black hairs; first segment swollen and somewhat reddish below; second segment slightly more than half as long as first; third segment three fourths length of first and one and one fourth the length of second; total length of antennae one fourth as long as body. Palpi black with gray pollen and whitish hairs; apical palpal segment reddish at base and along inner margin. Proboscis black.

**Thorax.** Dorsum of mesothorax with grayish brown pollen which obscures the black integument; three dull brown pollinose stripes run the length of the thorax, the two lateral ones ending anteriorly before the humeral calli; the middle stripe is very narrowly divided by a grayish brown pollinose line. Scutellum grayish brown pollinose; mesonotum and scutellum with gray and black hairs inter-

\*This species is named for Dr. Cornelius B. Philip who has in many ways done much to further the writer's interest in the Tabanidae.

mixed. Pleura gray pollinose with many long gray hairs. Knob of halteres black; shaft brownish. *Legs*: Coxae black covered with gray pollen and long white hairs; trochanters black; femora reddish brown with apical one fifth black; tibiae reddish with apical one sixth black; front and middle metatarsi reddish brown with apical half black; hind metatarsi reddish brown with apical one fourth black; remaining tarsal segments black but showing reddish at the base in certain lights. *Wings*: Costal and subcostal cells infuscated to stigma which is very dark; infuscation at apex of marginal cell separated from stigma but running into extreme apex of first submarginal cell; remainder of marginal and submarginal cells hyaline except for a faint infuscation in both directly beneath the stigma; areas along veins which outline distal portion of both basal cells infuscated; a dark spot at bifurcation of third longitudinal vein and one at bifurcation of fourth longitudinal vein which includes the immediate portions of adjacent cells. Anal cell closed at margin in right wing, barely open in left wing.

*Abdomen*. Brownish gray pollinose with faint, narrow, yellowish margins along apices of all segments except first; first segment with a brownish black spot which extends the full length and about two thirds the width of the segment; second segment with a black spot which extends three fourths the width of the segment but which does not quite reach the posterior border which is invaginated in the form of a triangle which nearly cuts the marking in two; third and fourth segments with markings similar to the second but which extend across the entire segment and have progressively wider gray posterior margins and invaginated triangles; fifth segment with a narrow brownish black base; sixth and remaining segments without dark markings. Venter dull gray pollinose with faint, narrow, yellowish margins at apices of all segments except first.

*Type data*. Holotype, female: 10 miles southeast of Lebanon, Oregon, August 25, 1935 (Geo. Ferguson). Holotype in writer's collection.

*Comparative notes*. *S. philipi* is easily separated from all Nearctic species of *Silvius* by the structure of the antennae which are unusually robust and differ decidedly in the proportions of the segments from all described Nearctic species. An antennal formula, using the first segment as the unit of measurement, would read: 1—0.58—0.75. The antennal formulae of the other species of Nearctic *Silvius* with maculate wings are: *S. sayi* (based on one paratype), 1—0.50—2.5; *S. quadrivittatus* (based on average of several specimens) 1—0.54—2; *S. quadrivittatus* var. *texanus* (based on average of type and nine female paratypes), 1—0.50—1.93; *S. laticallus* (based on one specimen), 1—0.40—2.13; *S. pollinosis* (based on two specimens), 1—0.53—2.72. In all these species the length of the third antennal segment varies from about two to nearly three times the length of the first; with *S. philipi* it is only three fourths the length of the first.

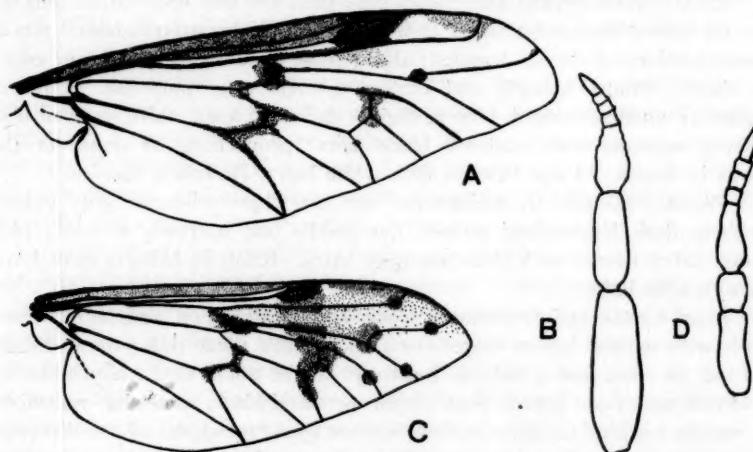
The wing and body patterns of *S. philipi* are also distinctive, but possibly not beyond the limits of variation of some of the related species.

***Silvius quadrivittatus* (Say) var. *texanus* n. var.**

Female. Length, 9.46 mm.

*Head*. Frontoclypeus grayish white pollinose, central portion denuded; cheeks grayish white pollinose with scattered gray hairs which become more dense below; central portion of each cheek with a denuded area which encroaches upon the lateral margins of the frontoclypeus and is narrowly separated from the eye;

front above antennae grayish white pollinose with scattered gray hairs; frontal callosity shining brownish black, comparatively large and with a narrow line extending toward the median ocellus. Antennae slender; first segment reddish brown at base becoming darker toward apex; second segment reddish brown; third segment black; first two segments with black hairs, third segment with whitish pollen; second segment slightly less than half the length of first; third segment twice as long as first and over four times the length of second; total length of antennae about one fifth as long as body. Palpi dark reddish brown with white hairs toward base. Proboscis reddish brown, blackish toward tip.



*Silvius philipi* n. sp., female. A, wing x10; B, antennae x25.

*Silvius quadriannulatus* var. *texanus* n. var. C, wing x10; D, antennae x25.

**Thorax.** Dorsum of mesothorax and scutellum with gray pollen and scattered whitish hairs over a black integument; three dark reddish brown pollinose stripes run the length of the thorax, only the center one actually reaching the scutellum; the central stripe is narrowly divided by a gray line; pleura gray with many rather long white hairs. Knob of halteres dark brown, shaft somewhat lighter. Legs: All coxae and trochanters black with gray pollen and white hairs; femora fuscous with a reddish brown tinge in certain lights; tibiae dull yellow, apical third of anterior and apical fourth of middle and hind tibiae black; metatarsi dull yellow, apical third of anterior and apical fourth of middle and hind metatarsi black; remainder of tarsal segments black with traces of yellow at base. **Wings:** Costal cell dilutely infuscated to stigma; first submarginal cell dilutely and irregularly infuscated, the heaviest infuscation directly below stigma; first posterior cell with a mesal infuscation which joins the dark cloud enveloping the bases of the second and third posterior cells, the apex of the discal cell and the adjacent portion of the fourth posterior cell. Other dark clouds envelop the crossveins at the apex of the basal cells, the bifurcation of the third longitudinal vein, and, subapically, the second longitudinal vein, both branches of the third longitudinal vein, and the upper branch of the fourth longitudinal vein. The anal cell is closed and shortly petiolate.

**Abdomen.** Brownish gray pollinose with white and black hairs intermixed; first segment with a dark spot beneath scutellum; segments two to six with rows of dark brown spots; two median rows begin on the second segment and gradually diminish in size being reduced to small dots along the base of the sixth segment; a lateral row along each side of the abdomen begins on the third and ends on the sixth segment; in each row there is one spot on each included segment. Venter gray pollinose with white hairs; lateral margins of fifth and sixth segments with a dark spot.

**Male.** Length, 8.30 mm. Easily associated with female.

**Head.** Frontoclypeus and cheeks gray pollinose and with rather long gray hairs; no central denuded area on frontoclypeus but area around lateral pits and adjacent portions of cheeks denuded; also a small denuded spot on lower edge of each cheek; frontal triangle and ocellar tubercle gray pollinose. First two segments of antennae reddish brown, slightly darker at apex; third segment black; first two segments with scattered black hairs; proportions of segments about same as in female. Palpi fuscous with white hairs. Proboscis fuscous.

**Thorax.** Dorsum of mesothorax and scutellum yellowish gray pollinose with three dark longitudinal stripes, the middle one narrowly divided; pleura fuscous; entire thorax with abundant gray hairs. Knob of halteres dark brown, shaft somewhat lighter.

**Legs.** Coxae and trochanters black with gray pollen and hairs; femora fuscous with reddish brown tinge; front and middle tibiae dull yellow; most of apical half of front and apical one fourth of middle tibiae black; hind tibiae reddish brown, apical one fourth black; front metatarsi black, somewhat yellowish at base; middle and hind metatarsi yellow, black at apex; remainder of tarsal segments black with traces of yellow at base. **Wings.** Essentially as in female.

**Abdomen.** Dull yellow with black and yellow hairs; first segment with a black mark beneath scutellum which reaches posterior margin; second to fifth segments with a double row of median spots which gradually diminish in size; third to fifth segments with a lateral row of spots on each side. Venter yellow with three rows of indistinct dark spots; apex of venter fuscous.

**Variations.** Females. Length, 8.1 to 9.5 mm. **Head:** In one specimen the antennae are almost completely fuscous; in another the frontoclypeus is pollinose in the center. **Legs:** Little variation in the legs; a few specimens have wholly black front metatarsi and the front tibiae half black. **Wings:** The density of infuscation of the costal cell varies from as dark as in *S. sayi* to considerably lighter; the apical infuscation varies but is always broader than in *S. sayi*; six specimens have a subapical spot on lower branch of fourth longitudinal vein; in a few specimens the wing membrane is quite dark. **Abdomen:** In two specimens the abdominal spots are much reduced laterally, but the four rows are still faintly indicated.

Males. Length, 7 to 8.39 mm. Little variation is exhibited by the males; in one specimen the legs are darker than in the allotype and the three rows of ventral abdominal spots are almost obscured by fuscous.

**Type data.** *Holotype*, female: College Station, Texas, May 24, 1931 (H. J. Reinhard); *allotype*, male: College Station, Texas, May 25, 1935 (H. J. Reinhard). In writer's collection.

*Paratypes.* One male College Station, Texas, May 28, 1928; one female Encino, Texas, May 28, 1932 (J. O. Martin); one female Brownwood, Texas, August 11, 1932 (R. H. Parker) in collection of Dr. C. B. Philip. Two males College Station, Texas, May 7, 1933 and May 25, 1935 (H. J. Reinhard); two females College Station, Texas, May 13, 1933 and May 4, 1934 (H. J. Reinhard); one female College Station, Texas, July, 1932 (J. C. Gaines); one female Bexar Co., Texas, April 24, 1932 (H. B. Parks) in collection of Texas Agricultural and Mechanical College. One female Uvalde, Texas, May 19, 1918 (J. C. Bradley) in Cornell University collection. One male College Station, Texas, April 24, 1934 (H. J. Reinhard); two females College Station, Texas, May 21, 1931 and June 17, 1933 (H. J. Reinhard); one female Bexar Co., Texas, June 20, 1929 (H. B. Parks) in writer's collection.

*Comparative notes.* Brennan's<sup>1</sup> statement that *Silvius sayi* is the only Nearctic species with maculate wings and infuscated costal cell has led to confusion regarding *S. quadriplagiatus* var. *texanus*. Philip's<sup>2</sup> description of the male of *S. sayi* actually should refer to the male of var. *texanus*. *S. sayi* in reality is more closely related to *S. pollinosus* from which it may be differentiated by the infuscated costal cell, intensified infuscation of the wing, and smaller size.

*S. sayi* may be separated from both typical *quadriplagiatus* and var. *texanus* by the small frontal callosity, completely pollinose frontoclypeus (with *quadriplagiatus* the frontoclypeus is rarely pollinose in the center), two rows of abdominal spots which lack the linear tendency of the usual four rows of *quadriplagiatus*, the absence of subapical spots on the longitudinal veins, and the presence of a bare, impressed "horseshoe" connecting the ocelli. In addition *sayi* is differentiated from typical *quadriplagiatus* by the infuscated costal cell and apical infuscation, predominately dark legs, and infuscated basal half of the first posterior cell; specimens of *quadriplagiatus* from McCook, Nebraska show a dark spot along the third longitudinal vein which partially includes the first posterior cell, but the basal half of the cell is not completely infuscated. The variety *texanus* is further separated from *sayi*, in addition to characters previously mentioned, by the apical costal margin being more broadly infuscated in *texanus*, the first posterior cell being more or less hyaline basally but crossed mesally by a cloud, and the first submarginal cell with a cloud connecting the stigma and the mesal cloud in the first posterior cell.

From typical *quadriplagiatus* both sexes of var. *texanus* may be separated by the infuscated costal cell, infuscated apical margin, generally darker legs and palpi, the mesal clouds in the first submarginal and first posterior cells, accentuated subapical spots on the longitudinal veins, and the general yellowish tint of the wing membrane. All these characters, however, are characters of degree and variations of typical *quadriplagiatus* may approach var. *texanus* in several respects. Specimens from several localities in Texas and Oklahoma show definite tinting of the costal cell and apical margin; a series of specimens from Galveston, Texas are quite close to var. *texanus* but have only faint indications of infuscation in the first submarginal and first posterior cells.

<sup>1</sup>Brennan, J. M. The Pangoniinae of Nearctic America (Tabanidae, Diptera). Univ. Kansas Sci. Bul. 22, No. 13: 249-401. 1935.

<sup>2</sup>Philip, C. B. Notes on certain males of North American horseflies (Tabanidae). Bul. Brooklyn Ent. Soc. 31: 189-197. 1926.

## KEY TO THE NEARCTIC SPECIES OF SILVIUS

1. Dichoptic (females) ..... 2
- Holoptic (males) ..... 9
2. Wings immaculate; yellow or reddish species ..... 3
- Wings maculate; gray species ..... 4
3. Frontoclypeus entirely pollinose; abdomen with conspicuous median triangles ..... *microcephalus* Wehr
- Frontoclypeus partially denuded; abdomen without median triangles ..... *gigantulus* (Loew).
4. Costal hyaline ..... 5
- Costal cell infuscated ..... 7
5. Frontal callosity distinctly more than half the width of front, narrowly separated from eyes ..... *laticallus* Brenn.
- Frontal callosity about half width of front, broadly separated from eyes ..... 6
6. Each branch of third longitudinal vein with a subapical spot ..... *quadrivittatus* (Say).
- Branches of third longitudinal vein without subapical spots *pollinosus* Will.
7. Antennae stout and comparatively long, third segment shorter than first ..... *philipi* n. sp.
- Antennae slender, third segment about twice as long as first ..... 8
8. Frontoclypeus completely pollinose, frontal callosity small, subtriangular, abdomen with two rows of spots; no subapical spots on longitudinal veins ..... *sayi* Brenn.
- Frontoclypeus denuded in center, frontal callosity large; abdomen with four rows of spots; subapical spots on second longitudinal vein, both branches of third longitudinal vein, and on one or both branches of fourth longitudinal vein ..... *quadrivittatus* var. *texanus* n. var.
9. Wings immaculate ..... 10
- Wings maculate ..... 11
10. Frontoclypeus entirely pollinose; abdomen with conspicuous median triangles ..... *microcephalus* Wehr.
- Frontoclypeus partially denuded; abdomen without median triangles ..... *gigantulus* (Loew).
11. Abdomen predominately yellowish; subapical spots on both branches of third longitudinal vein; not densely haired species; venter of abdomen with three rows of spots ..... 12
- Abdomen predominately dark; no subapical spots on branches of third longitudinal vein; thorax and base of abdomen with long white hair; venter of abdomen entirely dark or with a broad dark median band ..... 13
12. Costal cell and apical margin of wing infuscated; first submarginal and first posterior cells with a median cloud; femora mostly dark ..... *quadrivittatus* var. *texanus* n. var.
- Costal cell and apical margin hyaline or slightly tinted; first submarginal and first posterior cells usually hyaline medially; femora mostly yellow ..... *quadrivittatus* (Say)
13. Dorsum of thorax with three narrow gray stripes; first abdominal tergite almost entirely black, remaining segments mostly black with pale invag-

iations along the posterior margin; apical palpal segment black; venter of abdomen uniformly fuscous; cheeks in vicinity of lateral pits of frontoclypeus denuded, denuded area extending upon frontoclypeus *laticallus* Brenn. Thoracic stripes wide; abdominal tergites yellow laterally including first; apical palpal segment mostly yellow; venter of abdomen yellow laterally on first three segments; only lateral pits of frontoclypeus denuded .....  
..... *polinosus* Will.

The writer wishes to express his appreciation to Dr. C. B. Philip, Dr. H. J. Reinhard, and Dr. Alan Stone for the loan of specimens. He is also grateful to Dr. Philip for his advice and assistance in studying the material.

#### AN APPARENTLY NEW EUPITHECIA FROM EASTERN NORTH AMERICA (GEOMETRIDAE: LEPID.)\*

BY J. McDUNNOUGH,

Ottawa, Ont.

In the course of my studies in this interesting genus I have gradually accumulated a few specimens of a species which on genitalic characters (both ♂ and ♀) is abundantly distinct from any of our other eastern species. As these genitalic characters of practically all the described species are known to me, due to a study of type material, I believe the present species to be undescribed and offer the following description. The specimens are, unfortunately, not in the best of condition, but reference to the figures given of both male and female genitalia should render the identification comparatively easy, especially in the male where the abdominal plate can be observed *in situ* by denuding the eighth abdominal segment of a few scales.

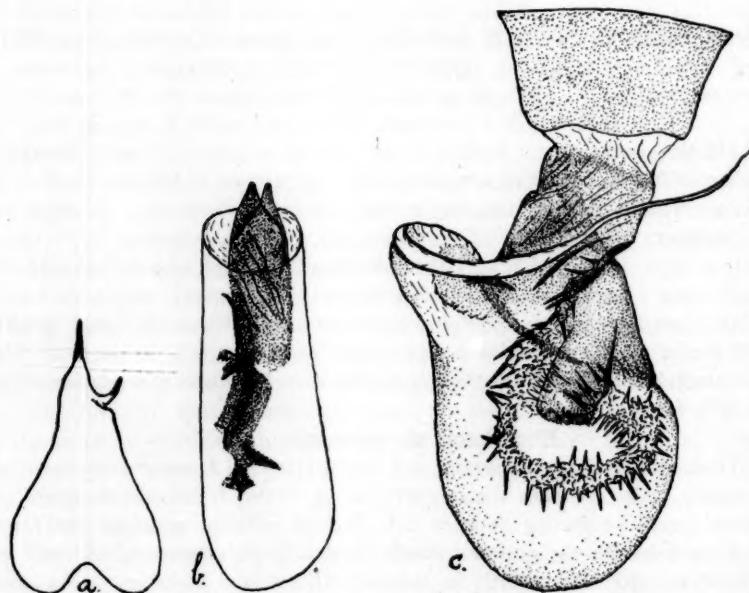
#### *Eupithecia sheppardata* n. sp.

Palpi rather short, projecting only slightly beyond front, evenly scaled with deep smoky scales and with slight admixture of white; front smooth-scaled, with the usual small projecting anterior tuft, largely whitish, with the tuft and a narrow band before the antennal bases, smoky brown; antennae of male very shortly ciliate, still more shortly in female. Thorax and abdomen smoky brown with slight admixture of white; the blackish band on the anterior abdominal segments, so prominent in certain species, is here only very faintly indicated. Primaries narrowly triangular, the apex rather pointed in appearance, but not sharply so; the outer margin convex; the color is a rather light gray-brown with all maculation very indefinite and not sharply defined; as far as can be determined the t. a. line is angled outwardly below costa, the t. p. line is concavely curved outwards to a point opposite the discal dot where it is sharply angled and descends rather rigidly oblique to inner margin; the median space shows the usual waved parallel lines, but all very faint; the discal dot is a mere dark point. S. t. line fairly prominent, dull light gray, crenulate, relieved inwardly by rather broad smoky shading which forms a rectangular patch at costa. A faint smoky terminal line. Fringes concolorous with faint indication of smoky checkering. Secondaries pale dull gray with rather broad smoky basal, postmedian and terminal bands; through the latter evidences of a pale, strongly dentate, submarginal line can be

\*Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

observed, especially toward anal angle; discal dot small, faint. Fringes as on primaries. Beneath very pale smoky with small discal dots on all wings, beyond which are smoky, crenulate, postmedian and subterminal lines, separated on costa of primaries by a faint creamy shade. Expanse ♂, 18 mm.; ♀, 19 mm.

*Genitalia*—Male: Claspers with small, slightly raised projection on ventral margin near middle. Aedeagus armed apically with two large pointed superimposed pieces of chitin, behind which are a curved rodlike piece and an irregularly twisted ribbon. Ventral plate drawn out into a long sharp point from the base of which on the right side projects a strong curved spine.



*Eupithecia sheppardata* n. sp. a. Male ventral plate of eighth segment; b. Aedeagus; c. Female genitalia.

*Female*: Ostium broadly rectangular, roughened. Ductus bursae short, broad, faintly chitinized in distal section; upper third of Bursa strongly chitinized, remainder unspined, except for a curved band of strong spines which descends on the dorsal side from the junction of the ductus bursae half-way to the fundus, then curves around to the left and circles round again to end in a broad chitinous rod, projecting downward as an extension of the chitinous neck. On the right side the unarmed portion of the bursa is drawn out into a sack-like projection from which the *ductus seminalis* arises dorsally, crossing the bursa to the left.

*Holotype*—♂, Montreal, Que., June 20, 1937 (A. C. Sheppard); No. 4379 in the Canadian National Collection, Ottawa.

*Allotype*—♀, same data, June 9.

*Paratypes*—1 ♂, St. Hilaire, Que., May 25, 1931 (A. C. Sheppard); 1 ♂, Sardinia, N. Y., June 24, 1937 (L. R. Rupert); 1 ♀, Biscotasing, Ont., June 18,

1931 (K. Schedl).

I have much pleasure in naming the species for that enthusiastic Montreal Lepidopterist, Mr. A. C. Sheppard, who supplied the majority of the specimens and through whose courtesy they are retained in our National Collection.

As regards its position, *sheppardata* may be placed in the *fletcherata* group on the strength of certain similarities between the ventral plates.

A NEW STONEFLY FROM BAFFIN LAND (PLECOPTERA,  
CAPNIIDAE).  
LL

BY WILLIAM E. RICKER,

International Pacific Salmon Fisheries Commission, New Westminster, B. C.

***Capnia hantzschii* n. sp.**

*Male*: Length of body (dried) 5 mm., of the forewings 1.8 mm., of the hindwings 1.5 mm. Color of body black, the abdomen with a mid-dorsal brown line; legs dark brown.

Head as wide as the prothorax, rugulose on the occiput. Interocellar distance 2.0 times that from eyes to ocelli. Pronotum as long as wide, its sides curved, its angles rounded; slightly rugulose, especially in the regions near the distinct anterior marginal groove and beside the mid-line. Wings dusky, abbreviated; forewing reaches to the 1st abdominal segment.

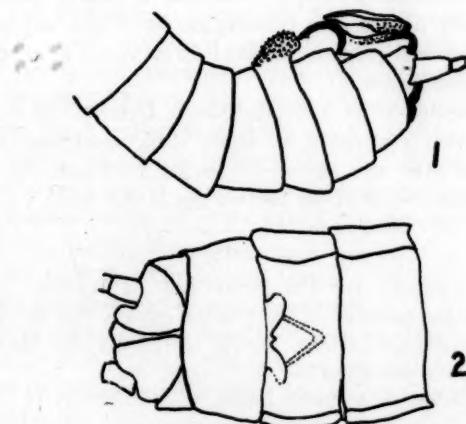


Fig. 1. *Capnia hantzschii*. Abdomen of ♂ holotype viewed from the side, the tip of the supra-anal process displaced from its normal position underneath the tubercle of the 7th tergite. Fig. 2. The same. Ventral view of the terminal abdominal segments of the ♀ allotype.

Seventh abdominal tergite with a hemispherical tubercle situated on the posterior 2/3 of the segment and projecting over  $\frac{1}{2}$  of the 8th, closely set with blunt prickles. Supra-anal process shining black, consisting of a broad basal part, and a slender blunt tip decurved to fit under the tubercle of the 7th segment, this tip with a short blunt subterminal inferior tooth. Above the basal part of the process lie a pair of elongate processes, light in color, separated from each other by a narrow median space. They are attached to the main body of

the supra-anal process at its, and their, posterior ends, and they touch it again near their tips, but for most of their length are separated from it by an air space, visible in side view. Posterior margin of the 9th sternite produced and rounded. Sub-anal lobes broad, emarginate on the outer side, their tips bluntly rounded.

*Female*: Resembles the male except as follows. Length of body 7.5 mm., to tip of wings 9.0 mm. Wings not abbreviated, 7.5 mm. long, dusky. Sc meets R somewhat before the cord; one or two costal crossveins present in addition to the humeral; R sinuate beyond origin of Rs; Rs and M fork once; Cu<sub>1</sub> and Cu<sub>2</sub> are unforked.

Eighth sternite with a short subgenital plate, set slightly anterior to the hind margin of the segment, notched at the tip, with a V-shaped band of dark pigment anterior to it, as indicated by dots in figure 2. Other abdominal segments unmodified.

*Holotype*—♂ : Nettilling lake, Baffin Land, 7.vii.25; coll. J. D. Soper; in the Canadian National Collection, Ottawa.

*Allotype*—♀ : the same, 11.vii.25, in C.N.C.

*Paratypes*—1 ♂ 2 ♀ ♀, 7-11.vii.25, same location as holotype; in C.N.C. 1 ♂, 10.vii.10, Tikerakdjuak (on Nettilling lake), Baffin Land; coll. B. Hantzsch, S.J.; in the Zoologisches Museum der Universität, Berlin.

Of described American species, *C. hantzschii* is mostly closely related to *C. nearctica* Banks, which also has the tubercle on the ♂ 7th tergite, but differs in the shape of the supra-anal process. Related forms occur in northern Europe, for example *C. tenuis* Bengtsson.

The writer is indebted to Dr. J. McDunnough, Ottawa, and to Prof. Dr. H. Bischoff, Berlin, for the opportunity to study these specimens. The species is appropriately named after the explorer Bernard Hantzsch, who collected a single example during the course of his last voyage in the arctic.

#### NEWS AND VIEWS

##### QUEBEC SOCIETY FOR THE PROTECTION OF PLANTS

The thirtieth annual meeting of the Quebec Society for the Protection of Plants was held at Macdonald College, McGill University, on May 12th, 1938.

The following papers were presented:—

Georges Maheux.—Introduction du *Stilpnota salicis*.

Omer Caron.—Le nodule noir.

H. J. Miles.—Control of common scab of potato by chemical treatment of the soil.

G. Michaud and G. W. Corriveau.—La destruction de l'herbe à poux dans le district de Charlevoix-Est.

G. W. Corriveau.—Resistance de *Brassica campestris*, *Brassica arvensis* et *Raphanus raphanistrum*.

J. M. Cameron.—The choice of a method for analysing experimental results.

J. I. Beaupré.—Une épidémie de mouches à scie sur le sorbier (*Pristiphora geniculata* Dhn.).

I. H. Crowell.—Some observations on apple rust.

R. Mougeot.—Le cycle évolutif du *Pieris rapae*.

R. D. Cartier.—Enquêtes sur les espèces de mauvaises herbes et leur distribution dans la région Temiscamingue-Abitibi.

H. A. Gilbert.—Notes on the hop vine borer, *Gortyna immanis* Gn.

In the evening an address was given by Dr. N. H. Grace, of the National Research Council, Ottawa, on Plant Hormones.

Officers elected for 1938-1939 included the following:—President, Prof.

E. Campagna; Vice-president, Mr. L. S. McLaine; and Secretary-treasurer, Dr. E. Melville DuPorte.

#### ARMYWORM STARTS EARLY IN SOME OF THE SOUTHERN STATES

The armyworm has appeared this spring earlier than ever before in oat and alfalfa fields in the Delta section of west central Mississippi and northeastern Louisiana, according to the U. S. Department of Agriculture. This year's outbreak started even earlier than last year's which caught many farmers unaware and proved very costly.

Other major crop insect pests continue to show every sign of having come through the winter in large numbers and of beginning their seasonal activities somewhat earlier than usual—the natural result of a generally mild winter. Some insects had destroyed crops in a few areas before the first of April. Practically all of the most destructive insect pests, however, have not yet reached the critical period in their life cycle, when weather largely determines their fate.

#### WAR DECLARED ON NEW CROP PEST

The White-fringed Beetle, *Naupactus leucoloma*, has been previously reported from a few scattered areas in Mississippi, Florida, Alabama, and Louisiana. As these insects are due to reappear above ground late in June in the limited areas along the Gulf Coast, the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, with the co-operation of State Organizations, has mapped out a campaign of eradication and prevention of spread of the pest. If this campaign is successful the country may well be spared the cost of another insect capable of becoming destructive to a wide variety of crops. The Federal-State campaign is under the guidance of B. M. Gaddis.

White-fringed beetles do most of their damage as larvae—half-inch long, yellowish-white, fleshy grubs, somewhat curved and sparsely covered with hair. These grubs, which live entirely underground, feed on the roots of cotton, corn, peanuts, velvet beans, sugar cane, cabbage, sweetpotatoes, and other plants. Most of the plants on which the grubs have fed wither and die very soon. Those that survive never yield good crops.

There are no male white-fringed beetles. All are females, capable of laying eggs. Hence one beetle can start an infestation.

So far as entomologists have been able to determine, the white-fringed beetle first came to the United States sometime within the last seven or eight years, probably on shipments of produce from South America.

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#### RESEARCH NOTES

##### AN EFFECTIVE REPELLENT FOR BITING INSECTS

At the direction of the Dominion Entomologist the writer carried out a series of experiments during the past two seasons with a view to developing a satisfactory repellent for personal application against mosquitoes, blackflies and other blood-sucking insects. As a result of this work a new repellent has been developed which has proved very effective. Varying according to the time of day, the prevalence of biting insects, the temperature, the activity of the individual and other factors, the formula given below was found to give protection for periods varying from three to five hours:

Oil of thyme .....	$\frac{1}{2}$ fl. oz.
Concentrated extract of pyrethrum in mineral oil (extract of approx. 1/5 lb. of pyrethrum flowers per fl. oz. of concentrate) .....	1 fl. oz.
Castor oil .....	2 to 3 fl. ozs.
Anyone desiring a less oily mixture may substitute olive oil for castor oil, but the resulting period of protection may not be quite so long.	

Following complete coverage of exposed parts, which is essential, insects may approach closely or even alight, but will not bite until the repellent material has become weakened by evaporation or has been removed by mechanical means. During the experiments, insects occasionally alighted on treated parts and were paralysed before they could escape. As the extract of pyrethrum deteriorates in strong light and on exposure to air, the material should be placed in an amber glass bottle or metal container, which should be kept closed when not in use.

In addition to the experimental tests, this repellent has been used by foresters and other field workers, where biting flies were abundant. These reported that they were greatly impressed by its effectiveness. A detailed account of the experimental work carried out will be prepared for publication at a later date.

C. GRAHAM MACNAY.

Division of Entomology, Science Service, Ottawa.

#### MIGRATION OF MOTHS OF THE BEET WEB-WORM.

First generation adults of *Loxostege sticticalis* are exceedingly abundant this year in Saskatchewan, but as far as I am aware no records exist of migration of moths of this species. The following is an account of such a migration by Mr. R. C. Pengelly of Cupar, Sask.

"A migration of this type of moth (*Loxostege sticticalis*) occurred about five miles south of Cupar on June 18th, the flight being a few hundred yards wide and about three-quarters of a mile in length, the topmost moth seemed to be about twice the height of the telephone poles on the road allowance or about 40 feet. Driving through them in a motor-car quite resembled driving in heavy snow storm, the estimated density of the flight being about twenty per cubic foot. The moths were travelling in a southerly direction, and the following day many were found fluttering about in the lawn of my home, ten miles due south of Cupar."

Unfortunately for those who study migrations no specimens were preserved for dissection, but only one for determination. L. G. SAUNDERS.  
University of Saskatchewan.

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